

CLAIMS

What is claimed is:

- 1 1. A method for measuring low-power components of non-coherently sampled test
2 signals that include at least one tone each having a known frequency, comprising:
3 executing a DFT on the sampled test signal;
4 modeling spectral components of the at least one tone, including effects of
5 leakage induced by the at least one tone; and
6 adjusting the DFT by an amount prescribed by the modeled spectral components
7 to provide a substantially leakage-free measure of low-power components of the test
8 signal.
- 1 2. A method as recited in claim 1, wherein the step of modeling includes modeling
2 at least one spectral component of the at least one tone.
- 1 3. A method as recited in claim 2, wherein the step of modeling accounts for the
2 known frequency of each expected tone and a plurality of known sampling parameters
3 related to sampling the test signal.
- 1 4. A method as recited in claim 3, wherein the step of modeling includes applying
2 actual values from the DFT to determine the amplitude each of expected tone in the
3 modeled spectrum.
- 1 5. A method as recited in claim 4, wherein the actual values from the DFT
2 correspond to bins of the DFT containing each expected tone.
- 1 6. A method as recited in claim 3, wherein plurality of known sampling parameters
2 includes the number of cycles M_i of each expected tone of the test signal within the
3 sample window, the number of samples N within the sample window, and the sampling
4 rate F_s .

$$X_w[k] = \sum_{i=1}^p [A_i/2 (W(k/N - (1+\alpha_i)M_i/N)) + A_i^*/2 (W(k/N - (1-(1+\alpha_i)M_i/N)))]$$

6 k is any bin of the predicted DFT,
7 A_i is the complex amplitude of the component in bin k ,
8 p is the number of test tones in the test signal,
9 α_i is a ratio error in the sampling of the i^{th} test tone, and
10 $W(f) = e^{(-j2\pi f(N-1)/2)} \sin(\pi fN) / \sin(\pi f)$.

1 9. A method as recited in claim 1, wherein the low-power components comprise
2 noise and distortion in the test signal.

1 11. An apparatus for measuring low-power components of non-coherently sampled
2 test signals including at least one tone each having a known frequency, comprising:
3 means for executing a DFT of a sampled test signal;
4 means for modeling spectral components of the at least one tone, including effects
5 of leakage induced by the at least one tone; and
6 means for adjusting the DFT by an amount prescribed by the modeled spectral
7 components to generate a substantially leakage-free measure of noise and distortion in the
8 test signal.

12. An apparatus as recited in claim 11, wherein plurality of known parameters include the number of cycles M_i of each test tone of the test signal within the sample window, the number of samples N within the sample window, and the sampling rate F_s .

13. An apparatus as recited in claim 12, wherein the modeled spectral components have substantially the form—

$$X_W[k] = \sum_{i=1}^p [A_i/2 (W(k/N - (1+\alpha_i)M_i/N)) + A_i^*/2 (W(k/N - (1-(1+\alpha_i)M_i/N)))],$$

wherein

k is any bin of the predicted DFT,

A_i is the complex amplitude of the component in bin k ,

p is the number of tones in the test signal,

α_i is a ratio error in the sampling of the i^{th} test tone, and

$$W(f) = e^{(-j2\pi f(N-1)/2)} \sin(\pi f N) / \sin(\pi f).$$

14. An apparatus as recited in claim 13, wherein α represents the ideal, coherent sampling rate F_s divided by the actual sampling rate F_s' , minus one, or $\alpha = F_s/F_s' - 1$.

15. A method for testing the a non-coherently sampled test signal including at least one tone each having a known frequency, comprising:

applying a stimulus signal to an input of a device under test;

sampling a test signal from an output of the device under test;

executing a DFT on the sampled test signal;

modeling the spectrum of the at least one tone, including effects of leakage induced by the at least one tone; and

adjusting the DFT by an amount prescribed by the modeled spectrum to generate a substantially leakage-free DFT of the test signal.

